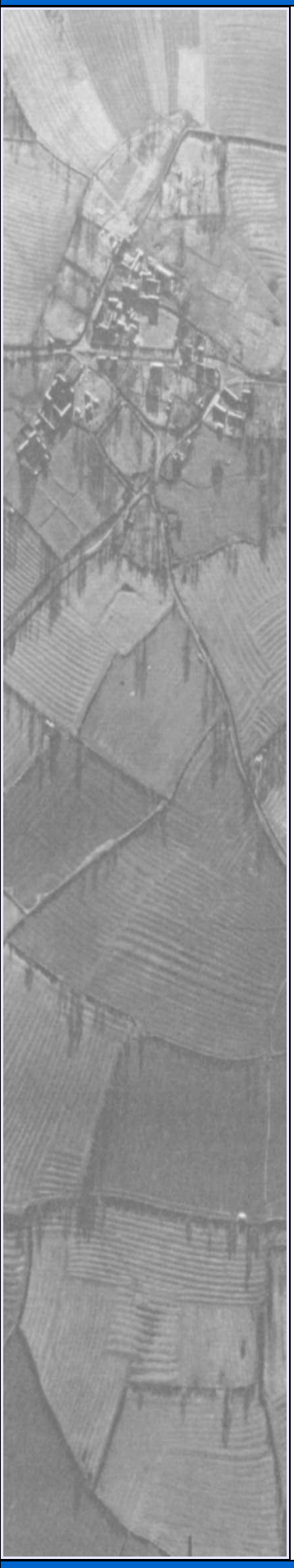

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Land at Bishopton Lane
Stratford upon Avon
Warwickshire

MAGNETOMETER SURVEY REPORT

for

Taylor Wimpey UK Ltd
& Miller Homes Ltd

David Sabin and Kerry Donaldson

May 2013

Ref. no. 476

ARCHAEOLOGICAL SURVEYS LTD

Land at Bishopton Lane
Stratford upon Avon
Warwickshire

Magnetometer Survey Report

for

Taylor Wimpey UK Ltd
& Miller Homes Ltd

Fieldwork by David Sabin, Francis Sabin & Richard Grove
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey dates – 3rd to 14th May 2013
Ordnance Survey Grid Reference – **SP 17985 55982**

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SUMMARY

A detailed magnetometer survey was carried out by Archaeological Surveys Ltd on land adjacent to Bishopton Lane on the north western edge of Stratford upon Avon in Warwickshire. The survey was commissioned by Taylor Wimpey and Miller Homes as part of an archaeological investigation into the 25ha site, which has been outlined for a proposed residential development. The survey located a number of enclosures, ditches and pits likely to indicate Romano-British occupation of the high ground at the south western end of the site. The anomalies correlate with a surface scatter of Roman pottery and burnt, fire-cracked pebbles. However, the majority of the anomalies throughout the survey areas relate to former ridge and furrow and removed land boundaries, indicating that the site has been used for agricultural purposes, possibly since the Medieval period.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Taylor Wimpey UK Ltd and Miller Homes Ltd to undertake a magnetometer survey of an area of land near Bishopton Lane, Stratford upon Avon, Warwickshire. The site has been outlined for a proposed residential development and the survey forms part of an archaeological assessment of the site.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin, so that they may be assessed prior to development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* and Institute for Archaeologists (2002) *The use of Geophysical Techniques in Archaeological Evaluations*. The work has been carried out to the Institute for Archaeologists (2011) *Standard and Guidance for Archaeological Geophysical Survey.*

1.3 Site location, description and survey conditions

1.3.1 The site is located on the north western edge of Stratford upon Avon in Warwickshire. It lies within the parish of Old Stratford and Drayton. It is bounded to the south east by Bishopton Lane, to the south west by The Ridgeway, north west by the A46 and north east by the Stratford upon Avon canal. It is centred on Ordnance Survey National Grid Reference (OS NGR) SP 17985 55982, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 25ha of land, split within four land parcels. Area 1 in the south western part of the site is approximately 9.2ha. Area 2 to the north east of Area 1 is approximately 10.7ha. Areas 1 and 2 both contained a patchy rape crop emerging from roughly ploughed land at the time of survey. Area 3 lies to the north east of Area 2 and is approximately 4.5ha. The field had been recently cultivated and an arable crop was emerging. Area 4 is approximately 0.8ha and contains scrubby vegetation along a narrow strip adjacent to the canal at the north eastern end of the site.

1.3.3 The south western end of Area 1 includes the eastern part of a small hilltop plateau at around 65m ODN and this gives views over Stratford and the Avon valley. Land then falls away towards the east and north east with Areas 2 – 4 being flat and lying at around 50m ODN.

1.3.4 The ground conditions within Area 1 and 2 were unfavourable for the collection of magnetometer data due to very rough ploughing and a tall crop causing difficult walking conditions. Ground conditions within Area 3 were more favourable. Tall vegetation and trees within Area 4 partly impeded data collection. Weather conditions during the survey were variable but mainly fine.

1.4 Site history and archaeological potential

1.4.1 The survey area does not contain any archaeological sites or findspots. In the wider vicinity, Roman pottery, coins and other small finds have been located in sites both to the north and south of the survey area. Bishopton Lane follows an Early Medieval saltway known as Sealt Street. This forms a crossroads with the Roman road that leads to Alcester which is less than 200m to the south of the site and several other former Medieval trackways are now followed by modern roads in the vicinity. Former Medieval occupation is known from Bishopton DMV, 550m to the north, and Shottery, 850m to the south. The site also contains evidence for former ridge and furrow cultivation on wartime aerial photographs, indicating that the site was used for agricultural purposes from the Medieval period.

1.4.2 The northern part of the site is bounded by the Stratford upon Avon Canal, constructed between 1793 and 1816. Immediately north of this is the site for the former Royal Victoria Spa, built in 1837. Although these sites may have little direct impact upon the survey area, it is possible that material associated with construction, maintenance or dredging of the canal may exist within the northern part of the survey area.

1.4.3 The site is likely to have been used for agricultural purposes since the Medieval period. However, field observations within the south eastern part of the site (Area 1), on high ground adjacent to The Ridgeway, indicated a scatter of Romano-British pottery sherds along with burnt and cracked pebbles. The scatter appeared to be confined to the higher hilltop area with no

evidence of Roman pottery across the majority of the site.

1.5 Geology and soils

1.5.1 The underlying geology is from the Blue Lias and Charmouth Mudstone Formation (BGS, 2013).

1.5.2 The overlying soils across the site are unmapped by likely to be from the Denchworth association which are pelo-stagnogley soils. These consist of slowly permeable, seasonally waterlogged clayey soils (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometer surveys carried out on similar soils and geologies have demonstrated that there can be a strong contrast between the fill of cut features and the material into which they are cut. Natural features within the underlying soils and geology can also be present.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a Bartington Grad 601-2 gradiometer. The instrument effectively measures a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally.

2.2.2 The instrument is extremely sensitive and is able to measure magnetic variation to 0.01nanoTesla (nT), with an effective resolution of 0.03nT. The data are limited to ±100nT when surveying with the highest sensitivity. All readings are saved to an integral data logger for analysis and presentation.

2.2.3 The instrument is operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change.

2.2.4 It can be very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that may be associated with large ferrous objects, geological/pedological features, 'magnetic debris' within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme.

2.2.5 The Bartington gradiometer undergoes regular servicing and calibration by the manufacturer. A current assessment of the instrument is shown in Table 1 below.

Sensor type and serial numbers	Bartington Grad - 01 – 1000 Nos. 084, 085
Date of certified calibration/service	Sensors 084 and 085 - 17th August 2012 (due Aug 2014)
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instrument was considered to be in good working order prior to the survey, with no known faults or defects.

2.2.6 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 40m by 40m grids (1600m²) giving 6400 measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 2008).

2.2.7 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Leica GS10 RTK GPS and oriented parallel with the long axis of the site. The GPS is used in conjunction with Leica's SmartNet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

2.3 Data processing and presentation

2.3.1 Magnetometry data downloaded from the Grad 601-2 data logger are analysed and processed in specialist software known as ArcheoSurveyor. The software allows greyscale and trace plots to be produced for presentation and display. Survey grids are assembled to form an overall composite of data (composite file) creating a dataset of the complete survey area. Appendix C contains specific information concerning the survey and data attributes and is derived directly from ArcheoSurveyor; this should be used in conjunction with information provided by Figure 02.

2.3.2 Only minimal processing is carried out in order to enhance the results of the survey for display. Raw data are always analysed, as processing can modify anomalies. The following schedule sets out the data and image processing used in this survey:

- clipping of the raw data at ±10nT to improve greyscale resolution,
- clipping of processed data at ±3nT to enhance low magnitude anomalies,
- de-stagger is used to enhance linear anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix B for further information on the specific processes carried out on the data. Appendix C metadata includes details on the processing sequence used for each survey area.

2.3.3 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area.

2.3.4 The main form of data display prepared for this report is the greyscale plot. Both 'raw' and 'processed' data have been shown followed by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.5 Graphic raster images in bitmap format (.BMP) are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by ArcheoSurveyor from left to right. Prior to displaying against base mapping, raster graphics require a rotation of

131.7° anticlockwise to restore north to the top of the image upon insertion into AutoCAD.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2009 and AutoCAD LT 2007, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.

2.3.7 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of four survey areas covering approximately 25ha. A very small zone close to the north western part of Area 2 was unsurveyable due to boggy ground and deep ruts. Parts of Area 4 could not be surveyed due to tall and dense vegetation.

3.1.2 Magnetic anomalies located can be generally classified as positive linear and discrete positive responses of archaeological potential, positive anomalies of an uncertain origin, anomalies associated with land management, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance.

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset that would render the results invalid or unrepresentative of anomalies within the site.

3.2.2 Poor surface conditions and tall vegetation in three of the survey areas did result in minor positional errors during traversing. This type of error is common in magnetometer surveys and is easily corrected for during data processing. In addition, the magnetometer sensors frequently showed rapid drift due to the weather conditions during the survey period. Although mainly fine weather prevailed, rapid heating and cooling of the sensors was apparent as a consequence of low air temperatures and variable amounts of direct sunlight on the instrument. The temperature instability is manifest as slight and variable levels of imbalance and heading error. Again, the effect is common and easily corrected during data processing.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading CAD layer names and plot colour	**Description and origin of anomalies**
Anomalies with archaeological potential AS-ABST MAG POS LINEAR ARCHAEOLOGY AS-ABST MAG POS DISCRETE ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc..
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS AREA UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management AS-ABST MAG BOUNDARY	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation.
Anomalies with an agricultural origin AS-ABST MAG RIDGE AND FURROW	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are

	present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 2: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 417725 255750, see Figures 07 & 08.

Anomalies of archaeological potential

(1) – A group of positive linear, rectilinear and discrete anomalies are located in the most south western part of the survey area. These anomalies form a group of associated enclosures, linear ditches and pits. They are centred on a square enclosure 58m wide which contains another central enclosure 26m across. A rectilinear enclose is joined on the eastern side, with smaller, more curvilinear irregularly shaped enclosures to the west. To the south there are a number of smaller enclosures and pits, that are not so clearly defined. The site underlies the ridge and furrow which has truncated and obscured some of the features. This part of the survey area contained Roman pottery sherds, and it is possible that these anomalies relate to a Romano-British farmstead covering at least 1.6ha located on a knoll of high ground overlooking the Roman road to the south and the Avon valley to the east and south east.

Anomalies with an uncertain origin

(2) – Located close to the eastern edge of the survey area are a number of discrete positive anomalies. While it is possible that these indicate pit-like features, it is not possible to determine their origin.

(3) – A positive linear anomaly extends across the eastern part of the survey area. It is parallel with the former land boundary (4) located 120m to the west and may relate to a former ditch-like feature.

Anomalies associated with land management

(4) – A former land boundary is located within the centre of the survey area. It is defined in the north by two parallel linear anomalies indicating infilled field ditches and a zone of magnetic debris in the south. This field boundary is still mapped on the 2006 Ordnance Survey Explorer Map.

Anomalies with an agricultural origin

(5) – The survey area contains evidence for former ridge and furrow either side of the former land boundary (4).

Anomalies associated with magnetic debris

(6) – Along the eastern field boundary are two linear anomalies with dipolar responses. While it is possible that there may be an association with the former ridge and furrow, they appear to contain magnetic material, possibly indicating a ceramic pipe or drain.

Anomalies with a modern origin

(7) – Magnetic disturbance is a response to ferrous objects within and surrounding the site. These include electricity poles crossing the survey area, fencing to the south and a possible service or pipe along the western edge.

3.5 List of anomalies - Area 2

Area centred on OS NGR 418030 256020, see Figures 09 & 10.

Anomalies with an uncertain origin

(8) – A series of parallel positive linear anomalies are located close to the south eastern edge of the survey area. Although more clearly defined to the north west the former ridge and furrow may extend over them as very weak anomalies. It is possible that they relate to cut features, a possible track or agricultural anomalies.

Anomalies associated with land management

(9) – In the north western part of the survey area are several anomalies that relate to a former field boundary and water course.

Anomalies with an agricultural origin

(10) – A series of parallel linear anomalies relate to former ridge and furrow. In the north eastern part of the survey area some appear to have split or moved.

Anomalies associated with magnetic debris

(11) – Located in the south eastern part of the survey area is a zone containing weakly magnetic debris. It may indicate a spread of magnetically thermoremnant material, such as brick, pottery, or tile; however, the source of the material is uncertain.

Anomalies with a modern origin

(12) – Magnetic disturbance is a response to inspection covers of a sewer pipe in the northern part of the site, electricity poles and also a service extending along the

north eastern field boundary.

3.6 List of anomalies - Area 3

Area centred on OS NGR 418250 256257, see Figures 11 & 12.

Anomalies with an uncertain origin

(13) – An "L" shaped positive linear anomaly with some multiple dipolar response may indicate possible former agricultural activity, such as ridge and furrow or land drainage.

(14) – A fragmented, weakly positive linear anomaly extends across the central part of the survey area. It appears to extend between a number of inspection covers indicating that it is likely to be associated with a buried service.

Anomalies with an agricultural origin

(15) – Parallel linear anomalies relate to former ridge and furrow.

Anomalies associated with magnetic debris

(16) – Magnetic debris close to the northern field boundary is likely to be a response to material used to infill a former field boundary ditch.

Anomalies with a modern origin

(17) – A discontinuous, strongly positive linear anomaly extends across the site and appears to relate to a buried service.

3.7 List of anomalies - Area 4

Area centred on OS NGR 418357 256353, see Figures 11 & 12.

Anomalies with an uncertain origin

(18) – The survey area contains a pit-like anomaly and a short, positive linear anomaly. The origin of these anomalies cannot be determined.

Anomalies associated with magnetic debris

(19) – Strongly magnetic debris can be seen throughout the survey area. This indicates a response to material with a ferrous content, and may relate to ground

make up associated with the construction or maintenance of the adjacent canal.

4 CONCLUSION

4.1.1 The detailed magnetometer survey located a number of positive linear, rectilinear and discrete anomalies that relate to a group of enclosures, ditches and pits in the south western part of the site. Within this area, a surface scatter of Roman pottery was noted and the morphology of the anomalies is similar to other Romano-British rural sites located by magnetometry in the south of the county. The anomalies may also indicate development and change over a long period, possibly extending back to the prehistoric.

4.1.2 The majority of the site contains evidence for former ridge and furrow, and removed field boundaries, indicating that it has been within arable cultivation since the Medieval period.

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Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±5nT and ±1nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

De-stagger

Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount. Data lost at the end of each traverse are extrapolated from adjacent value in the same row.

Deslope

Corrects for striping and distortion caused by metal objects/services etc.. The process calculates a curve based on a polynomial best fit mathematical function for each traverse. This curve is then subtracted from the actual data.

Edge Match

Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. It then subtracts the difference between the means from all datapoints in the selected area.

FFT (Fast Fourier Transform) spectral filtering

A mathematical process used to determine the frequency components of a traverse. Repetitive features, such as plough marks, produce characteristic spectral zones that can be suppressed allowing greyscale images to appear clearer.

Appendix C – survey and data information

Area 1 raw magnetometer data

COMPOSITE
Filename: J476-mag-Area1-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 08/05/2013
Assembled by: on 08/05/2013
Direction of 1st Traverse: 131.7 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 1120 x 400
Survey Size (meters): 280 m x 400 m
Grid Size: 40 m x 40 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 10.00
Min: -10.00
Std Dev: 1.94
Mean: -0.31
Median: -0.23
Composite Area: 11.2 ha
Surveyed Area: 8.4901 ha

Processes: 3
1 Base Layer
2 Clip from -30.00 to 30.00 nT
3 Clip from -10.00 to 10.00 nT

Source Grids: 68
1 Col:0 Row:0 grids\01.xgd
2 Col:0 Row:1 grids\02.xgd
3 Col:0 Row:2 grids\03.xgd
4 Col:0 Row:3 grids\38.xgd
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50 Col:4 Row:9 grids\63.xgd
51 Col:5 Row:1 grids\16.xgd
52 Col:5 Row:2 grids\17.xgd
53 Col:5 Row:3 grids\23.xgd
54 Col:5 Row:4 grids\24.xgd
55 Col:5 Row:5 grids\25.xgd
56 Col:5 Row:6 grids\64.xgd
57 Col:5 Row:7 grids\65.xgd
58 Col:5 Row:8 grids\66.xgd
59 Col:5 Row:9 grids\67.xgd
60 Col:6 Row:1 grids\18.xgd
61 Col:6 Row:2 grids\19.xgd
62 Col:6 Row:3 grids\20.xgd
63 Col:6 Row:4 grids\21.xgd
64 Col:6 Row:5 grids\22.xgd
65 Col:6 Row:6 grids\68.xgd
66 Col:6 Row:7 grids\69.xgd
67 Col:6 Row:8 grids\70.xgd
68 Col:6 Row:9 grids\71.xgd

Area 1 processed magnetometer data

COMPOSITE
Filename: J476-mag-Area1-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 0.91
Mean: 0.03
Median: 0.00
Composite Area: 11.2 ha
Surveyed Area: 8.4886 ha

Processes: 18
1 Base Layer
2 DeStripe Median Traverse: Grids: All
3 De Stagger: Grids: 65.xgd Mode: Both By: -2 intervals
4 De Stagger: Grids: 61.xgd Mode: Both By: -1 intervals
5 De Stagger: Grids: 57.xgd Mode: Both By: -1 intervals
6 De Stagger: Grids: 66.xgd Mode: Both By: -1 intervals
7 De Stagger: Grids: 62.xgd Mode: Both By: -1 intervals
8 De Stagger: Grids: 23.xgd Mode: Both By: -1 intervals
9 De Stagger: Grids: 12.xgd Mode: Both By: -1 intervals
10 De Stagger: Grids: 17.xgd Mode: Both By: -1 intervals
11 De Stagger: Grids: 15.xgd Mode: Both By: -1 intervals
12 De Stagger: Grids: 64.xgd Mode: Both By: -1 intervals
13 De Stagger: Grids: 11.xgd Mode: Both By: -1 intervals
14 De Stagger: Grids: 41.xgd Mode: Both By: -1 intervals
15 De Stagger: Grids: 40.xgd Mode: Both By: -1 intervals
16 De Stagger: Grids: 42.xgd Mode: Both By: -1 intervals
17 De Stagger: Grids: 28.xgd Mode: Both By: 1 intervals
18 Clip from -3.00 to 3.00 nT

Area 2 raw magnetometer data

COMPOSITE
Filename: J476-mag-Area2-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 13/05/2013
Assembled by: on 13/05/2013
Direction of 1st Traverse: 131.7 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 1120 x 480
Survey Size (meters): 280 m x 480 m
Grid Size: 40 m x 40 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 10.00
Min: -10.00
Std Dev: 2.37
Mean: 0.10
Median: 0.26
Composite Area: 13.44 ha
Surveyed Area: 9.901 ha

Processes: 2
1 Base Layer
2 Clip from -10.00 to 10.00 nT

Source Grids: 80
1 Col:0 Row:0 grids\01.xgd
2 Col:0 Row:1 grids\02.xgd
3 Col:0 Row:2 grids\03.xgd
4 Col:0 Row:3 grids\40.xgd
5 Col:0 Row:4 grids\41.xgd
6 Col:0 Row:5 grids\42.xgd
7 Col:0 Row:6 grids\43.xgd
8 Col:0 Row:7 grids\44.xgd
9 Col:0 Row:8 grids\45.xgd
10 Col:0 Row:9 grids\78.xgd
11 Col:0 Row:10 grids\79.xgd
12 Col:0 Row:11 grids\80.xgd

13 Col:1 Row:0 grids\04.xgd
14 Col:1 Row:1 grids\05.xgd
15 Col:1 Row:2 grids\06.xgd
16 Col:1 Row:3 grids\37.xgd
17 Col:1 Row:4 grids\38.xgd
18 Col:1 Row:5 grids\39.xgd
19 Col:1 Row:6 grids\46.xgd
20 Col:1 Row:7 grids\47.xgd
21 Col:1 Row:8 grids\48.xgd
22 Col:1 Row:9 grids\75.xgd
23 Col:1 Row:10 grids\76.xgd
24 Col:1 Row:11 grids\77.xgd
25 Col:2 Row:0 grids\07.xgd
26 Col:2 Row:1 grids\08.xgd
27 Col:2 Row:2 grids\09.xgd
28 Col:2 Row:3 grids\34.xgd
29 Col:2 Row:4 grids\35.xgd
30 Col:2 Row:5 grids\36.xgd
31 Col:2 Row:6 grids\49.xgd
32 Col:2 Row:7 grids\50.xgd
33 Col:2 Row:8 grids\51.xgd
34 Col:2 Row:9 grids\72.xgd
35 Col:2 Row:10 grids\73.xgd
36 Col:2 Row:11 grids\74.xgd
37 Col:3 Row:0 grids\10.xgd
38 Col:3 Row:1 grids\11.xgd
39 Col:3 Row:2 grids\12.xgd
40 Col:3 Row:3 grids\31.xgd
41 Col:3 Row:4 grids\32.xgd
42 Col:3 Row:5 grids\33.xgd
43 Col:3 Row:6 grids\52.xgd
44 Col:3 Row:7 grids\53.xgd
45 Col:3 Row:8 grids\54.xgd
46 Col:3 Row:9 grids\70.xgd
47 Col:3 Row:10 grids\71.xgd
48 Col:4 Row:0 grids\13.xgd
49 Col:4 Row:1 grids\14.xgd
50 Col:4 Row:2 grids\15.xgd
51 Col:4 Row:3 grids\28.xgd
52 Col:4 Row:4 grids\29.xgd
53 Col:4 Row:5 grids\30.xgd
54 Col:4 Row:6 grids\55.xgd
55 Col:4 Row:7 grids\56.xgd
56 Col:4 Row:8 grids\57.xgd
57 Col:4 Row:9 grids\68.xgd
58 Col:4 Row:10 grids\69.xgd
59 Col:5 Row:0 grids\16.xgd
60 Col:5 Row:1 grids\17.xgd
61 Col:5 Row:2 grids\18.xgd
62 Col:5 Row:3 grids\25.xgd
63 Col:5 Row:4 grids\26.xgd
64 Col:5 Row:5 grids\27.xgd
65 Col:5 Row:6 grids\58.xgd
66 Col:5 Row:7 grids\59.xgd
67 Col:5 Row:8 grids\60.xgd
68 Col:5 Row:9 grids\66.xgd
69 Col:5 Row:10 grids\67.xgd
70 Col:6 Row:0 grids\19.xgd
71 Col:6 Row:1 grids\20.xgd
72 Col:6 Row:2 grids\21.xgd
73 Col:6 Row:3 grids\22.xgd
74 Col:6 Row:4 grids\23.xgd
75 Col:6 Row:5 grids\24.xgd
76 Col:6 Row:6 grids\61.xgd
77 Col:6 Row:7 grids\62.xgd
78 Col:6 Row:8 grids\63.xgd
79 Col:6 Row:9 grids\64.xgd
80 Col:6 Row:10 grids\65.xgd

Area 2 processed magnetometer data

COMPOSITE
Filename: J476-mag-Area2-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.04
Mean: 0.05
Median: 0.00
Composite Area: 13.44 ha
Surveyed Area: 9.901 ha

Processes: 14
1 Base Layer
2 Clip from -30.00 to 30.00 nT
3 DeStripe Mean Traverse: Grids: 01.xgd 02.xgd 03.xgd 40.xgd 41.xgd 42.xgd Threshold: 2 SDs
4 DeStripe Mean Traverse: Grids: 04.xgd 05.xgd 07.xgd 08.xgd Threshold: 2 SDs
5 DeStripe Mean Traverse: Grids: 69.xgd 67.xgd 65.xgd Threshold: 2 SDs
6 DeStripe Mean Traverse: Grids: 07.xgd Threshold: 2 SDs
7 DeStripe Median Traverse: Grids: 10.xgd 11.xgd 12.xgd 31.xgd 32.xgd 33.xgd 52.xgd 53.xgd 54.xgd 13.xgd 14.xgd 15.xgd 28.xgd 29.xgd 30.xgd 55.xgd 56.xgd 57.xgd 16.xgd 17.xgd 18.xgd 25.xgd 26.xgd 27.xgd 58.xgd 59.xgd 60.xgd 19.xgd 20.xgd 21.xgd 22.xgd 23.xgd 24.xgd 61.xgd 62.xgd 63.xgd
8 DeStripe Median Traverse: Grids: 05.xgd 06.xgd 37.xgd 38.xgd 39.xgd 46.xgd 47.xgd 48.xgd 08.xgd 09.xgd 34.xgd 35.xgd 36.xgd 49.xgd 50.xgd 51.xgd
9 DeStripe Mean Traverse: Grids: 43.xgd 44.xgd 45.xgd Threshold: 2 SDs
10 DeStripe Median Traverse: Grids: 68.xgd 66.xgd 64.xgd
11 Edge Match (Area: Top 40, Left 0, Bottom 79, Right 159) to Right edge
12 DeStripe Median Traverse: Grids: 78.xgd 75.xgd 72.xgd 70.xgd
13 DeStripe Mean Traverse: Grids: 79.xgd 80.xgd 76.xgd 77.xgd 73.xgd 74.xgd 71.xgd Threshold: 2 SDs
14 Clip from -3.00 to 3.00 nT

Area 3 raw magnetometer data

COMPOSITE
Filename: J476-mag-Area3-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 14/05/2013
Assembled by: on 14/05/2013
Direction of 1st Traverse: 315 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 960 x 320
Survey Size (meters): 240 m x 320 m
Grid Size: 40 m x 40 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 10.00
Min: -10.00
Std Dev: 2.12
Mean: -0.36
Median: -0.23
Composite Area: 7.68 ha
Surveyed Area: 3.8582 ha

Processes: 3
1 Base Layer
2 Search & Replace From: 32000 To: 32000 With: 32702
3 Clip from -10.00 to 10.00 nT

Source Grids: 37
1 Col:0 Row:3 grids\18.xgd
2 Col:0 Row:4 grids\19.xgd
3 Col:0 Row:5 grids\20.xgd
4 Col:0 Row:6 grids\21.xgd
5 Col:0 Row:7 grids\22.xgd
6 Col:1 Row:3 grids\17.xgd
7 Col:1 Row:4 grids\23.xgd
8 Col:1 Row:5 grids\24.xgd
9 Col:1 Row:6 grids\25.xgd
10 Col:1 Row:7 grids\26.xgd
11 Col:2 Row:1 grids\14.xgd
12 Col:2 Row:2 grids\15.xgd
13 Col:2 Row:3 grids\16.xgd
14 Col:2 Row:4 grids\27.xgd
15 Col:2 Row:5 grids\28.xgd
16 Col:2 Row:6 grids\29.xgd
17 Col:2 Row:7 grids\30.xgd
18 Col:3 Row:1 grids\11.xgd
19 Col:3 Row:2 grids\12.xgd
20 Col:3 Row:3 grids\13.xgd
21 Col:3 Row:4 grids\31.xgd
22 Col:3 Row:5 grids\32.xgd
23 Col:3 Row:6 grids\33.xgd
24 Col:4 Row:0 grids\05.xgd
25 Col:4 Row:1 grids\06+09.xgd
26 Col:4 Row:2 grids\07+10.xgd
27 Col:4 Row:3 grids\08.xgd
28 Col:4 Row:4 grids\34.xgd
29 Col:4 Row:5 grids\35.xgd
30 Col:4 Row:6 grids\36.xgd
31 Col:5 Row:0 grids\01.xgd
32 Col:5 Row:1 grids\02.xgd
33 Col:5 Row:2 grids\03.xgd
34 Col:5 Row:3 grids\04.xgd
35 Col:5 Row:4 grids\37.xgd
36 Col:5 Row:5 grids\38.xgd
37 Col:5 Row:6 grids\39.xgd

Area 3 processed magnetometer data

COMPOSITE
Filename: J476-mag-Area3-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 0.93
Mean: -0.03
Median: 0.00
Composite Area: 7.68 ha
Surveyed Area: 3.8582 ha

Processes: 11

1 Base Layer
2 Search & Replace From: 32000 To: 32000 With: 32702
3 DeStripe Median Traverse: Grids: 17.xgd 23.xgd 24.xgd 25.xgd 26.xgd 16.xgd 27.xgd 28.xgd 29.xgd 30.xgd
4 DeStripe Median Traverse: Grids: 11.xgd 12.xgd 13.xgd 31.xgd 32.xgd 33.xgd
5 DeStripe Median Traverse: Grids: 35.xgd 36.xgd
6 DeStripe Median Traverse: Grids: 34.xgd
7 DeStripe Mean Traverse: Grids: 05.xgd 06+09.xgd 07+10.xgd 08.xgd 01.xgd 02.xgd 03.xgd 04.xgd Threshold: 0.25 SDs
8 DeStripe Mean Traverse: Grids: 37.xgd 38.xgd 39.xgd Threshold: 0.5 SDs
9 DeStripe Mean Traverse: Grids: 18.xgd 19.xgd 20.xgd 21.xgd 22.xgd Threshold: 0.25 SDs
10 DeStripe Mean Traverse: Grids: 14.xgd 15.xgd Threshold: 0.5 SDs
11 Clip from -3.00 to 3.00 nT

Area 4 raw magnetometer data

COMPOSITE
Filename: J476-mag-Area4-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 14/05/2013
Assembled by: on 14/05/2013
Direction of 1st Traverse: 131.7 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 960 x 80
Survey Size (meters): 240 m x 80 m
Grid Size: 40 m x 40 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 10.00
Min: -10.00
Std Dev: 5.32
Mean: -1.94
Median: -1.72
Composite Area: 1.92 ha
Surveyed Area: 0.4331 ha

Processes: 2
1 Base Layer
2 Clip from -10.00 to 10.00 nT

Source Grids: 9
1 Col:0 Row:0 grids\09.xgd
2 Col:0 Row:1 grids\10.xgd
3 Col:1 Row:0 grids\07.xgd
4 Col:1 Row:1 grids\08.xgd
5 Col:2 Row:0 grids\05.xgd
6 Col:2 Row:1 grids\06.xgd
7 Col:3 Row:0 grids\04.xgd
8 Col:4 Row:0 grids\02+03.xgd
9 Col:5 Row:0 grids\01.xgd

Area 4 processed magnetometer data

COMPOSITE
Filename: J476-mag-Area4-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 2.11
Mean: -0.03
Median: 0.00
Composite Area: 1.92 ha
Surveyed Area: 0.4331 ha

Processes: 3
1 Base Layer
2 DeStripe Median Traverse: Grids: All
3 Clip from -3.00 to 3.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire (see inside cover for address). Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

Surveys are reported on in hardcopy (recycled paper) using A4 for text and A3 for plots (all plots are scaled for A3). Three copies will be sent to Warwickshire County Council planning archaeologist/HER.

This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.5.19.3 (geophysical data analysis),
- ProgeCAD Professional 2009 (report graphics),
- AutoCAD LT 2007 (report figures),
- OpenOffice.org 3.0.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data produced by the survey and report include the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- AutoCAD DWG files in 2000 and 2007 versions,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures.